*65TH BIRTHDAY FEATURE — PART 2

From WIRELESS to ELECTRONICS

One sweeping change after another!

The past 30-odd years have been a period of drastic change both for the electronics industry and for the magazine itself. But no single development had a more profound and lasting effect than the emergence of solid-state technology. Engineers, technicians and hobbyists alike had either to adapt to it, or drop out!

by NEVILLE WILLIAMS

Back in the '50s and '60s, when it was all happening, there was no special exemption for the staff of *Electronics Australia*. We were very much at the technical cross-roads. Conditioned by decades of valve circuitry, and with a commitment to many thousands of like-minded readers, we had to absorb and interpret the new solid-state concept, without appearing to be over-anxious to abandon the old.

Ironically, from the earliest days of "cats-whiskers" and galena (lead sulphide) crystals, experimenters had dreamed about the possibility of somehow inducing crystals to amplify signals, rather than just detect them, thereby combining their reputed "sweetness" of tone with economy in battery drain. Occasionally, over the years, isolated experimenters claimed to have succeeded — without ever being to able to repeat their results.

At an academic level (see "The Beginnings of Solid State Physics", London, The Royal Society, 1980) the behaviour of electrons in solids had been the subject of speculation and research in Europe and elsewhere from the turn of the century. In Jan 1930, U.S. patent 1,745,175, issued to Dr J.S. Lilienfeld, documented what can now be classed as NPPN and PNNP transistors. A subsequent Lilienfeld patent (U.S. 1,900,018, March 7, 1933) showed an elemental NPN transistor operating in common emitter mode, and an P-N junction functioning as a variable capacitor.

But such had been the progress in valve-based technology over the same period, that the solid-state concept was virtually ignored by the electronics industry until after World War II. Only then, in mid 1948, with a new era of consumer electronics ahead and with the valve technology nudging physical limits, the frustrating half-century of solid state speculation and research was finally climaxed by the announcement of practical transistors. This was by three scientists attached to the Bell Laboratories: William Shockley, John Bardeen and Walter Brattain.

A further 10-odd years was to elapse, however, before their now historic announcement was translated into large-scale production and a new regime of practical, transistor based equipment. As it happened, Australian manufacturers and consumers alike were largely preoccupied with the introduction of television during that interim period, although key companies were positioning themselves for the coming solid-state revolution.

The new era arrives

Looking back to those early '50s, I can well remember the release of germanium signal diodes such as STC's ubiquitous GD3 and the Philips/Mullard "OA-" series. Unlike the earlier "Westectors" — basically miniature copper-oxide rectifiers — germanium diodes proved reliable and efficient from the outset, in a wide range of circuit applications.

They even removed much of the mystique from the traditional crystal set. One was denied the anticipation of trying this catswhisker with that crystal, in a search for an elusive super-sensitive spot. Over-the-counter germanium diodes worked first-up — and that was that!

I also remember a call from the late Graham Hall of Ducon, to say that he was sending over some sample silicon power diodes "that will supersede those bulky, inefficient valve rectifiers that you've been using in your receivers and amplifiers". This they certainly did!

The first transistors to reach our lab were odd point-contact and junction germanium types, of little immediate use for RF service but sufficient to permit a certain amount of basic "fiddling".

Our first "conversation piece" was a breadboard style receiver involving — as I recall — four of those early transistors, plus prototype audio driver and output transformers from RCS: simply a non-regenerative detector, followed by an amplifier stage driving two transis-

tors in class AB push-pull.

Gain and selectivity were limited but, on the signals that it could receive, it produced useful output from a sensitive loudspeaker, while operating at 6V from four ordinary torch cells. The promise for battery powered equipment — portable and automotive — was obvious.

Progress in transistor design was thereafter mirrored in a number of simple constructional projects, culminating in a full-scale transistorised portable receiver, the "Transporta-7" described in February 1959. This comprised a vinyl-covered wooden cabinet and an inner metal bracket which supported the loudspeaker and two circuit boards, one carrying the tuner section, the other an audio amplifier with class-AB output stage.

It performed very well and I used it for some years as a casual portable, much as ones with present-day transistor receivers. The one-time experimenters' dream had become a reality: acceptable quality with economy of battery drain.

But old habits die hard. The issue carrying the design was ready for distribution when the company publisher suddenly realised that the poster had been overlooked — the one normally supplied for display by newsagents. Would editor John Moyle please scribbled out the few eye-catching words necessary to occupy the space?

He duly obliged and a few days later the resulting poster was on display all around Australia:

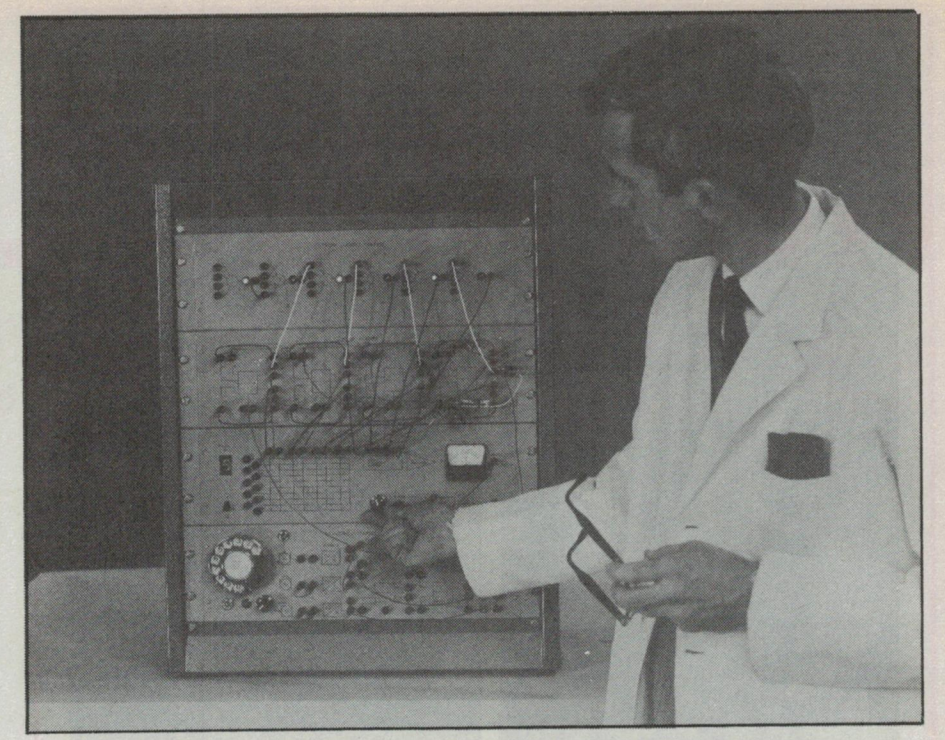
A 7-VALVE
TRANSISTOR
RECEIVER

Tragedy intervenes

Sadly, editor John Moyle was not to share in the technological explosion that characterised the solid-state era.

As an active radio amateur, a former president of the WIA (Wireless Institute of Australia) NSW Division, and a federal councillor of the same body, he had been nominated to represent the interests of Australian amateurs at the 1959/60 ITU (International Telecommunications Union) conference at Geneva.

Before leaving, he had not been a well man but, characteristically, decided to fulfil the assignment first and worry about his health later. On the way back from Geneva, he planned to follow up matters arising from an earlier fact-finding tour in 1956, and to spend some time with veteran American publisher Hugo Gernsback, with whom we had had a long and cordial relationship.



A somewhat younger Jim Rowe, proudly showing off the first EA Logic Demonstrator. This was described in the issues for April and May 1967, as the culmination of our first series of articles on digital concepts.

But as the conference drew to a close, John had to seek medical help. A Swiss doctor diagnosed cancer and advised him to fly straight home, while he was still able to do so. He died in March 1960, leaving the future of the magazine in the hands of the team which he had done so much to consolidate and inspire. His obituary was published in the April 1960 issue under the heading "Engineer, Writer and Musician". The same issue carried his final article on the conference: "ITU: How the amateurs fared".

A couple of months later, I had my own share of trauma, although minor by comparison. While working on a project in my backyard "shack", I hurried out into the damp, wintry night, slipped on a wet concrete step and ended up with a broken femur. Next morning, my wife had to ring Phil Watson with the news that I would be on a traction in Parramatta hospital for an indeterminate number of weeks, and that he'd have to be the new instant editor!

So while, for the next four months, I wrote and edited what articles I could, propped up on pillows, it fell to Phil to make the on-the-spot editorial decisions.

Transistors take over

By 1960, with both germanium and silicon transistors, plus related devices, pouring off the production lines, their ruggedness, small size, operating economy and low cost offered undeniable attractions across the whole range of electronic equipment. Equally, their compatability with printed circuit boards or "PCBs" fitted in with industry moves towards mechanised assembly and soldering.

In relatively short order, most new consumer equipment was "transistorised", along with test equipment and a variety of electronic gadgetry that would not have been practical in the valve era. The changeover took a little longer in the case of hifi power amplifiers, TV receivers and transmitting equipment, which had to await the development of reliable high power and/or high frequency devices.

As far as the magazine was concerned, we had little choice but to "move with the times", conforming to the worldwide industry switch from valves to solid state. It was a move that tended to polarise readers, for reasons that had a lot to do with the basic difficulty of visualising solid-state theory.

Valve based technology had always lent itself to comprehension by the "mental picture" process. It was relatively easy to visualise electrons being emitted from a heated cathode and attracted across a vacuum to a positively charged anode; to appreciate the modifying effect of intervening grids on the

The above pictures strictly belong with the first of these articles, but they've only become available to us since then. At left are Wireless Weekly editors and brothers Braith (left) and Ross Hull, with Ross Hull again at right with a homemade telescope. (Courtesy Ross Hull Jr.)

electron steam, and the way in which valves could function as rectifiers, detectors, amplifiers and oscillators. Physically, they could be seen to be operating and, by breaking one open, one could examine the structure in detail.

When it came to building valve equipment, the sockets provided logical anchor points beneath the chassis and, to a hobbyist, wiring was both an exercise in workmanship and a reminder of circuit functions as the connections were effected between the valve electrodes and various peripheral components.

Not so easy to follow

By contrast, solid-state technology was and still is less "transparent". While the processes may be clear enough to those versed in molecular physics, they do not lend themsleves at all well to explanations based on diagrams and metal pictures.

Despite the valiant efforts of technical writers, transistors remained, for many, enigmatic 3-legged blobs, rendered even more so by an endless confusion of terms and type numbers.

Again, with transistors normally assembled on PC boards, wiring had more to do with getting leads through the right holes, as per a layout diagram, than taking a perceptive interest in the individual copper tracks.

Wiring became an even more "mechanical" routine with the emergence of ICs (integrated circuits) particularly the "dedicated" types, which combine multiple circuit functions in small, multi-legged chips.

During that period of basic change, some relished the new technology others had no choice but to embrace it; some coped as best they could, while not a few dropped out quietly with the last generation of valve equipment — broadly the last batch of B&W TV receivers in the mid '70s and the few remaining valve based hifi amplifiers.

As it turned out, the magazine's move into solid-state technology was spear-headed by a young engineer who joined the staff shortly before the death of John Moyle. While the rest of us were still, for necessity, technically "bilingual", with a foot in each camp (!) it fell to Jim Rowe and our then new draftsman Bob Flynn to sort out the early confusion of terms and symbols and to come up with adequately illustrated articles and handbooks.

A new title

My chief role, in those days, was to "steer the ship" and a change in course seemed to be indicated.

Back in 1939, the "& Hobbies" was judged to be a necessary and appropriate part of the title but, with electronics playing an ever-increasing role in science and technology, space devoted to non-electronic topics was clearly not serving the best interests of either readers or advertisers. So the decision was taken that, henceforth, the magazine would concentrate on technology, popular science, hobbies, activities and interest that had some tangible connection with electronics.

In fact, the editorial content had been moving in that direction for some time and even Calvin Walters, our popular and free-ranging science writer through the formative years, began so to bias his choice of subjects.

To match the change in course, a new name *Electronics Australia* — abbreviated to *EA* — seemed to be desirable and a memo to that effect was duly despatched to the management of our parent company.

I shall never forget the incredulity with which it was greeted by the company's then editorial manager, Lou Leck, who knew a great deal about producing newspapers and popular magazines but to whom "electronics" was an obscure buzz-word used mainly by space-age weirdos.

It was only with the greatest misgivings that he finally accepted my assurance that it was also commonly used and understood by all our existing readers and advertisers; it might even attract others who were being put off by the down-market connotation of "& Hobbies". He, in turn, convinced the Board and, in April 1965, "R,TV & H" disappeared and "EA" took its place.

The name change certainly proved timely, because the availability of solid-state devices encouraged the construction of a whole array of new electronic gadgetry, as well as a new range of updated test equipment, receivers and amplifiers.

No longer was the cost and complexity dictated by the number of valve functions that the constructor could afford, accommodate or provide power for. With transistors, and more especially ICs, circuit functions could be expanded or added for the price of a few small components and a minor increase in the area of a PC board.

Glancing back through the indexes that immediately follow the name

change, I noted an electronic anemometer, a pipe and wiring tracer, motor speed controllers of various kinds, model train controllers and power supplies, an electronic metronome, a "decision maker", fluorescent lamp inverters, an electronic thermometer, a projector timer, a crystal clock, gas laser, burglar alarm, light dimmers, a metal locator — plus an assortment of circuits and ideas under the old "Reader Built It" heading.

Instruments listed included R/C bridges, audio signal generators, a tone burst generator, an audio millivoltmeter, a "dip" oscillator, "Q" meter, crystal calibrator, and more.

In the audio music field, there were phono, tape and guitar preamplifiers, an add-on 16ft voice for organs, a vibrator generator, volume compressor, solid-state "Theremin" and the popular EA "Musicolour" — not to mention a variety of amplifier and receiver projects.

Featured in the period 1965-70, most of these would by now have been updated or superseded. Who, these days would bother to build their own crystal clock?

Since 1970, virtually all our projects have been based on constantly evolving solid-state technology, ranging from relatively simple gadgets to the ambitious Series 200 Playmaster amplifier and the state-of-the-art Playmaster stereo AM/FM tuner.

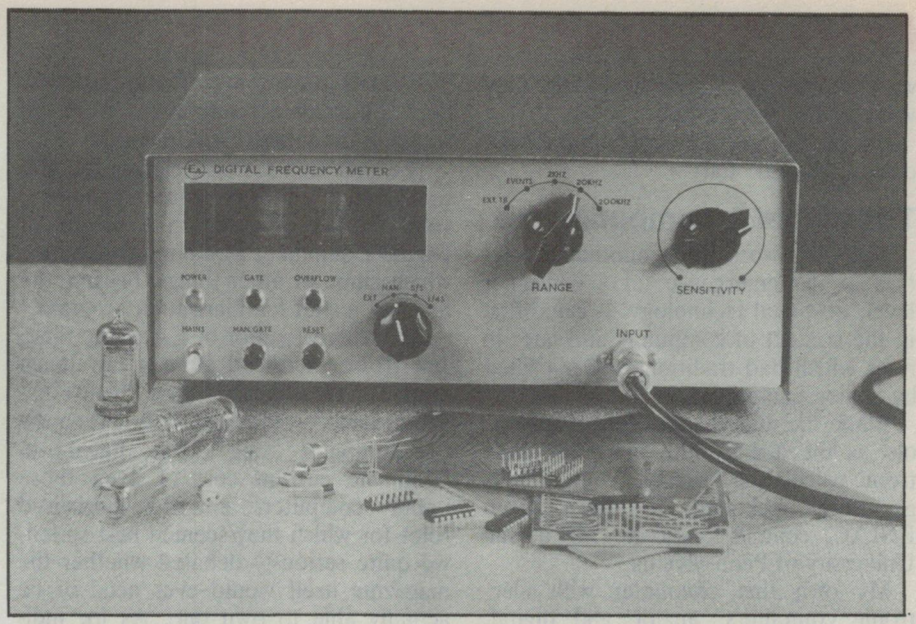
The revolution is complete. Valves and valve type components exist mainly for a few specialised functions, for replacement purposes, for nostalgia and for those hifi fans who insist on reversing the 60-year old adage. Valves sound sweeter than "crystals"!

Reader enquiry service

While the variety and novelty of such projects served to generate and maintain reader interest in do-it-yourself electronics, they also created a major problem for our technical staff.

Virtually from the outset, our policy had been to assist individual readers, who had run into problems with their projects, either by direct mail or through the columns of the magazine. In this respect, we were probably being more ambitious than any other comparable magazine in the world.

Actually, it wasn't too difficult in the early days, because fault symptoms in the limited range of valve projects could usually be recognised without having to search back through circuits and articles. But, as the range and complexity of projects increased, especially in the context of solid-state technology, it became necessary to establish an extensive filing and record system so that current technical staff could more easily cope with past projects.



Our first digital frequency counter project, which appeared in the issues for February-June 1970. It used gas discharge tubes for readout, with a mixture of RTL, DTL and ECL ICs.

With hindsight, the service probably became too accessible at its peak involving three full-time secretarial staff and imposing an impossible load on the technical staff and the assistant editor.

It was a matter of morale, as well as time and money. The technical staff would be keen to get on with a project or article with which each was involved — only to be reminded that they had not yet answered their fair share of the week's mail! In the end, we had no option but to limit correspondence to more manageable proportions.

Import duties cut

In 1972, Federal Government initiative totally changed the complexion of the electronics industry. Faced with the need to accept more imports to balance export earnings, the Whitlam labor government drastically reduced tariffs, including those on electronic components and equipment.

The decision signalled a flood of imported components which were at least as good and generally cheaper, than those produced locally. The same was true of built-up equipment, notably domestic, portable and car radio receivers, small to medium-size TV sets, audio-hifi components test equipment, communications equipment, etc. The impact on the local industry was devastating, with many factories forced to close.

For hobbyists, the effects were quite complex. Through enterprising parts dealers, they gained ready access to new high-tech components, often keenly priced. But against that, the supply of such components has often been selective and erratic. Again, the cost incentive to build one's own has been eroded by the availability of affordable built-up equipment at all levels. (How many amateurs, these days, use home constructed "rigs"?)

Even where the urge to acquire experience has prevailed, familiarity with built-up equipment has heightened expectation that the home-built unit should "look the part" — hence high-tech designs, with professional looking panels, cabinets and PC boards.

Like it or not, over the last decade or so, home constructors have tended to become assemblers of pre-digested kits, rather than students of the "Teach Yourself Radio" and "Learn While You Build" articles).

There is obviously a place for ambitious, professional looking projects — and there have been any number of them over the last few years — but I can never quite forget the pleasurable experiences I, and others, have re-lived, while generating simple articles for the magazine re-creating a more selective crystal set, or a humble little regenerative short-waver!

It might even be that the resurgence of interest in old valve radios is more than mere nostalgia; that it's as much a rejection of "pre-digested" routines; that part of the motivation is to grapple

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with circuits at a basic level, be they valve or transistor based.

But forgive me. I've inadvertently put on my "Forum" hat!

The digital & computing era

The '70s also saw yet another revolution in the emergence, at a consumer level, of digital technology. It came first in the context of computers and later in roles which had traditionally been filled by analog equipment.

While the digital concept is at least as old as the abacus, the first fully electronic calculating machine (computer) is generally reckoned to have been ENIAC, commissioned in 1945 at the University of Pennsylvania.

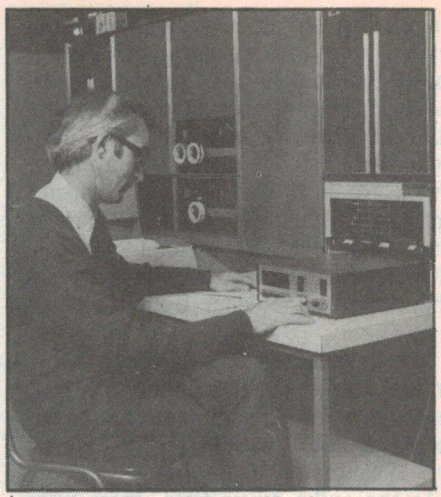
My own first encounter with electronic computers, analog and digital, was at the Commonwealth Aircraft Laboratories in Melbourne, my most vivid recollection being a room full of racks crammed with thousands of twin-triode valves, all glowing warmly and presumably awaiting their turn to lose emission.

Solid-state technology subsequently reduced those early monsters from room size to furniture size but, while they rated a mention in feature articles, they still seemed far removed from the technical activities of EA readers.

The first step towards closing the gap came when our then parent company, John Fairfax, invested in a couple of Digital Equipment PDP8 minicomputers which amongst other things, became the focus of a staff familiarisation program.

As technical editor of EA at the time, Jim Rowe sacrificed quite a few lunch hours for the chance to gain "hands on" experience — and was duly bitten by the computer "bug". But, having in mind the current cost of even those "mini" computers, and the specialised roles for which they seemed best suited, we quite seriously debated whether the magazine itself would ever need or be actually able to own one. As for individual readers, it seemed an even more remote possibility.

So, initially, we were resigned to publishing articles to explain the rudiments of logic theory and its representation in electronic circuitry. The highlight of this phase was a Logic Demonstrator (April/May '67), a project which filled a teaching role very well, but had no other function. After sitting around in



Jim Rowe shown trying out his historic EDUC-8 computer project in mid 1974, with the Digital Equipment PDP-8 minicomputer that had inspired it visible in the background.

our lab for some time, admired but never used,it was finally donated to a youth training group.

Then came our first actual build-it-yourself computer, introduced in August 1974, a project that actually tied as a world first with one published in the American magazine "Radio Electronics". With due parental pride, Jim Rowe insisted on calling it the "EDUC-8", signifying an educational, 8-bit computer.

Unfortunately, not everyone noticed — or conceded — the play on words and Jim has had to live, ever since, with sly references to his 'E-DUCK-ATE"!

I might add that designing the EDUC-8 project took Jim almost twelve months of work (all in his own time), and probably placed his marriage under some strain.

Even in 1974, however, the everyday role of computers was still a matter for speculation. "An emerging group of computer "nuts" was insisting that, one day, we would be using them for routine lab and office jobs, but the fact remains that the issue in which "EDUC-8" first appeared did not carry a single advert for computer equipment aimed at John Citizen.

I doubt that many foresaw the enormous impact which the then new and costly LSI (large scale integration) chips would have, when coupled with Asian and/or automated production methods. Until it actually happened, I know of no-one who would have credited the release of the technically advanced VZ-200 and VZ-300 computers through the Dick Smith organisation, for an Australian retail price of $99.00.

Yet, if one can venture to "compare

apples with oranges", those mechanically basic $99 colour computers, operating from a humble 12V plug pack, may well have had more computing potential than the one-time rooms full of valve equipment referred to earlier.

The still current VZ-300 and the considerable assortment of more pretentious models which continue to be offered at highly competitive prices, not only provide an enticement to get involved, but also a strong disincentive for individuals or parts suppliers to do so at the build-one-yourself level. Not surprisingly, therefore, technical interest in the subject centres on the choice of equipment and the options by which it can be used to best advantage.

As for the magazine itself, every work in it has, for years, been readied for printing by computerised typesetting equipment. Most of the articles have been written and/or sub-edited on computer-based word processors, some in the EA office, others owned privately by staff members and contributors.

Taken at Neville Williams' retirement dinner in 1983, this shot shows him receiving a VZ-200 computer from current managing editor Jim Rowe.

So much for the early reservations which Jim Rowe and I shared, about the availability and affordability of basic computers.

"The best laid plans . . ."

Facing the '80s and my own pending retirement, everything looked shipshape for the future. We had a functional, though not pretentious, office/laboratory complex within a few hundred metres of Sydney Central railway station.

Assistant editor Phil Watson was due to retire but, while his position could be taken over by Greg Swain, Phil would still be on call on a casual basis. Jim Rowe was firmly entrenched as editor with Leo Simpson looking after product reviews, plus a laboratory team by now as much at home with solid-state and digital technology as their predecessors had been with valves and analog.

It was then that entrepreneur Dick Smith rocked the boat, by making Jim Rowe one of those offers that, as per the cliche, "he could not refuse". In consequence, the editorial team had to be restructured, with Leo Simpson moving to technical editor (ultimately editor) and my own period of service extended by a couple of years.

It proved a challenging and busy period, with the personal computer market virtually exploding and with push-button digital methodology invading the video, audio and receiver equipment market. Levers, mechanical switches, meters, dials and tuning condensers gave place to "logic" controls, not only in commercial equipment but in projects as well.

Home videos also "exploded" to the extent that, for good measure, we were able to found a new companion publication called "VideoMag", which was later hived off under a separate staff.

And now, yet another era

And that's about the way it looked when I officially retired in July 1983, leaving *Electronics Australia* in the able hands of Leo Simpson and Greg Swain.

What none of us foresaw were the complications that would subsequently arise and with which that team would have to cope.

Faced with a critical space problem at the Regent Street address, company management decided that EA could logically be transferred from the existing Fairfax subsidiary (Magazine Promotions) to a jointly owned publishing company (The Federal Publishing Co Pty Ltd), which already had a number of technically orientated magazines in its stable.

The trouble was that Federal was itself undergoing reorganisation, and the changeover turned out to be a double move to addresses first in Waterloo and then Alexandria, which were accessable for some members of staff but not to others. It added up to double trouble for a magazine which depends so heavily on staff continuity, plus laboratory and reference facilities.

That's why, over the last few issues, you've noted staff changes; a new face in the wheelhouse, with Jim Rowe back at the helm and a new crew to keep the ship moving.

As I said at the outset, the past 30-odd years has certainly been a period of drastic change and this, the most recent, is part of the pattern. On the law of averages, Jim Rowe & Co will be able to handle it! EA